

Hydrosteel 7000



Instrument User Manual V3.1



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Thank you for purchasing your Ion Science instrument.

The standard warranty of your instrument can be extended to up to five years on PhoCheck Tiger and two years on other Ion Science instruments.

To receive your extended warranty, you must register your instrument online within one month of purchase (terms and conditions apply.)

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Declaration of conformity

Manufacturer: Ion Science Ltd, The Way, Fowlmere, Cambridge, SG8 7UJ, UK

Product: Hydrosteel 7000

Product Description: a fixed continuous monitor for the measurement of Hydrogen flux through steel equipment. The flux is used as indication of internal corrosion. Hydrosteel 7000 is for use in Oil and Gas operations where H₂S, HF-acid, or high temperature corrosion are present. With a 4-20 mA analogue output Hydrosteel 7000 can be simply integrated into a DCS control system to give warning or control of high corrosion levels in the operating equipment.

Directive 94/9/EC **ATEX**

Identification:  II 2G Ex ia IIC T4 (-40°C ≤ Ta ≤ +60°C)

Notified Body: Baseefa Ltd, 1180, Buxton, UK

EC Type Examination Certificate(s)

Baseefa04ATEX0205 latest supplement Baseefa04ATEX0205 issue 4 issued 13th February 2009

Standards

BS EN 60079-0:2006 Electrical Apparatus for Potentially Explosive Atmospheres – General Requirement

BS EN 60079-11:2007 Explosive Atmospheres - Equipment Protection by Intrinsic Safety 'i'

BS EN 61010-1:2010 Safety requirements for electrical equipment for measurement, control and laboratory use – General requirements

Directive 2004/108EC Electrical Equipment – Electromagnetic Compatibility (EMC)

BS EN 61326:1997 (+A1/A2) Electromagnetic Compatibility (EMC) Equipment for measurement, control and laboratory use

CFR 47: 2004 Class B EMC – US standard

Clarifications of EMC performance to standards: With respect to BS EN 61326:1997 (+A1/A2) the Hydrosteel 7000 achieves performance criteria B (that is the apparatus continues to perform after the test but during the test a degradation of performance is seen).

Other Standards

BS EN ISO 9001:2008 Quality Management Systems – Requirements

BS EN 13980:2002 Potentially Explosive Atmospheres – Application of Quality Systems

On behalf of Ion Science Ltd, I declare that, on the date this product accompanied by this declaration is placed on the market, the product conforms to all technical and regulatory requirements of the above listed directives.

Name: Mark Stockdale

Position: Technical Director

Signature:

Date: 20th November 2008



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Statements

Responsibility for Use

Hydrosteel 7000 flux monitor for permanent installation provides flux readings that are subject to interpretation. Ion Science Ltd can accept no responsibility for the incorrect use that may cause harm or damage to persons or property.

Inadequate performance of the gas detection equipment described in this manual may not necessarily be self-evident and consequently equipment must be regularly inspected and maintained. Ion Science recommends that personnel responsible for equipment use institute a regime of regular checks to ensure it performs within calibration limits, and that a record be maintained which logs calibration check data. The equipment should be used in accordance with this manual, and in compliance with local safety standards.

Warnings

1. Please read and understand this User Manual fully before installing, operating or servicing the Hydrosteel.
2. Ensure you are in a SAFE area before carrying out any type of maintenance on the Hydrosteel 7000 Instrument.
3. Substitution of components may impair intrinsic safety and result in unsafe conditions.
4. For safety reasons, the Hydrosteel must only be operated and serviced by qualified personnel.
5. Refer to the certificate for clarification of any aspects of intrinsic safety or contact Ion Science Ltd or your local Ion Science Ltd representative.

Quality Assurance

Hydrosteel 7000 has been manufactured in compliance with ISO9001:2008 and BSEN 13980:2002, which ensures that the equipment supplied to our customers, has been designed and assembled reproducibly, and from traceable components.

Disposal

Dispose of Hydrosteel 7000, its components in accordance with all local and national safety and environmental requirements. This includes the European WEEE (Waste Electrical and Electronic Equipment) directive. Ion Science Ltd offers a take back service. Please contact us for more information.

Calibration Facility

Ion Science Ltd offer a calibration service including the issue of certification using equipment which are themselves traceable to UK national standards.

Legal Notice

Whilst every attempt is made to ensure the accuracy of the information contained in this manual, Ion Science accepts no liability for errors or omissions, or any consequences deriving from the use of information contained herein. It is provided "as is" and without any representation, term, condition or warranty of any kind, either express or implied. To the extent permitted by law, Ion Science shall not be liable to any person or entity for any loss or damage which may arise from the use of this manual. We reserve the right at any time and without any notice to remove, amend or vary any of the content which appears herein.



Packing list

Please take a little time to check the contents in the Hydrosteel shipment before installation.

Item	Description	Qty.
1	Hydrosteel 7000 monitor	1
2	This Manual	1
3	Applications Manual	1
4	Software CD	1
5	Modem cable	1
6	USB to RS232 adapter	1
7	HY7K conduit kit consisting of:	
7.1	Sample tube assembly	1
7.2	Han connector assembly	1
7.3	P clips for sample tube conduit	6
7.4	Thermocouple junction box	1
8	HY7K probe kit	
8.1	AT-S collector plate	1
8.2	Background probe	1
8.3	Magnetically attachable TC cable	2
8.4	Wire brush	1

Accessories include:

1	Banding kit consisting of:	
1.1	Banding tool	1
1.2	Banding (3/8") stainless steel (box 30.5m)	1
1.3	Buckles box of 100	1
2	Magnetic probe fixing kit (4 high temp magnets)	1



Introduction to Hydrosteel 7000

The Hydrosteel 7000 is an intrinsically safe instrument for the measurement of hydrogen flux from pipes and vessels. The unit is designed for operator free maintenance for up to one year, subject to correct installation, and appropriate power supply. During this time the unit will take unlimited measurements and log them internally. The unit has two 4-20 mA outputs that provide constant output of flux and surface temperature data. An RS232 port enables the download of internally stored data. The unit has been robustly designed with IP66 weather proofing for external installation in most environments.

Hydrosteel 7000 has been designed with a view to presenting trouble free installation, commissioning and maintenance. For maintenance we recommend the service exchange of the product. Disconnection of the unit for service can be carried out while the instrument is powered, by simple detachment of analyser connections, under intrinsically safe conditions.

The requirements for installation in Zone 1 hazardous area are summarised below and in the *Installation summary diagram*. The reader should refer to *Installation section*, and to the Hydrosteel 7000 ATEX certificate for further details.

- Power to instrument should be supplied via zener safety barrier or galvanic isolator.
- Two 4-20 mA receivers that supply loop power to hazardous area through appropriate safety barrier / galvanic isolator are needed.
- To ensure EMC compliance always use screened cables for both power and 4-20 mA outputs.
- Mounting to wall or frame with appropriate hole centres.
- Probe to be installed on equipment with sample tube connection made to Hydrosteel 7000. Unit must be within 10 m (32 ft) of probe test point.
- Weather protection for probe. It is recommended that the probe is insulated and clad professionally.

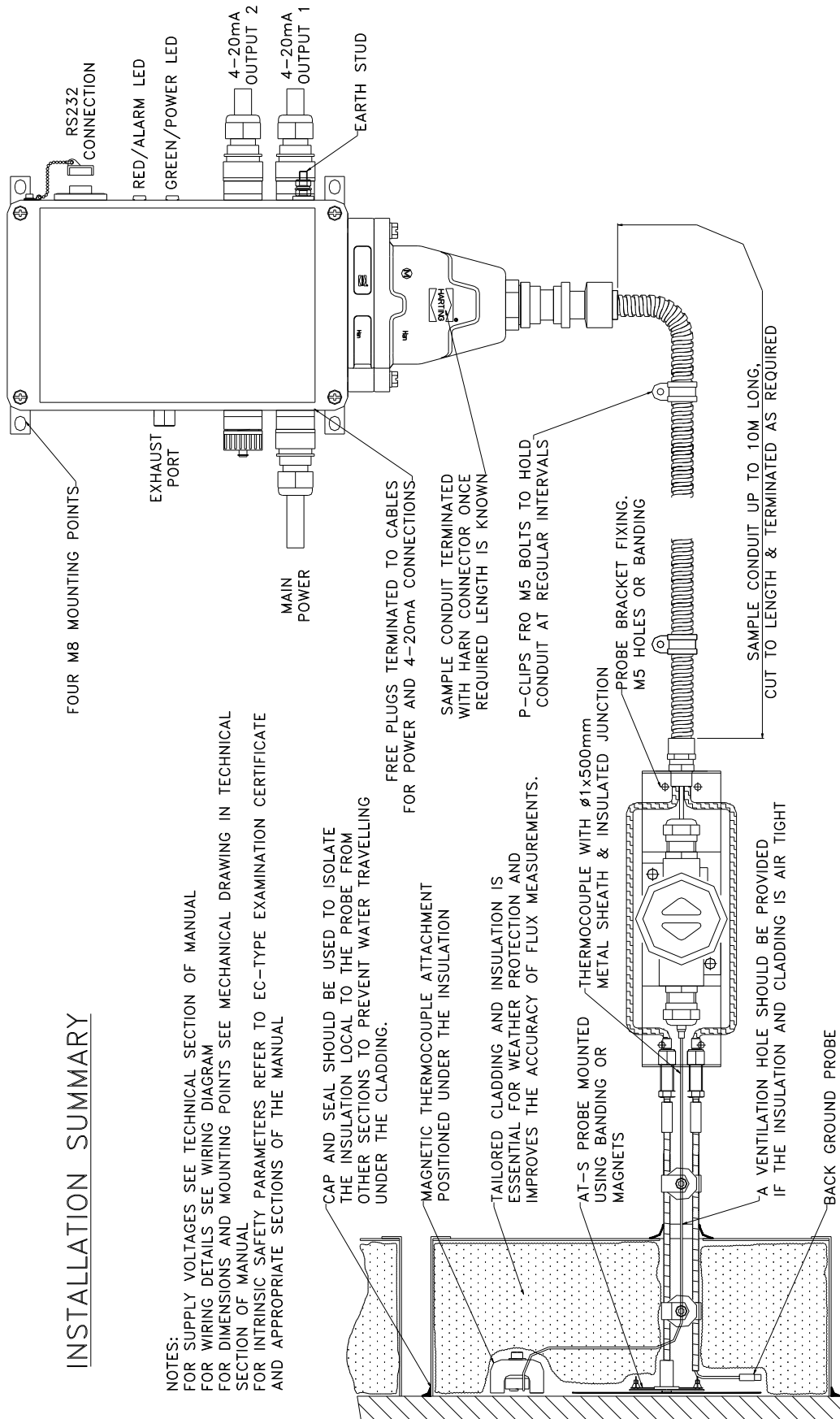
The Hydrosteel 7000 has been certified intrinsically safe by European notified body BASEEFA 2001 to the ATEX directive 94/9/EC. Baseefa04ATEX0205.



Introduction to Hydrosteel 7000

INSTALLATION SUMMARY

NOTES:
FOR SUPPLY VOLTAGES SEE TECHNICAL SECTION OF MANUAL
FOR WIRING DETAILS SEE WIRING DIAGRAM
FOR DIMENSIONS AND MOUNTING POINTS SEE MECHANICAL DRAWING IN TECHNICAL SECTION OF MANUAL
FOR INTRINSIC SAFETY PARAMETERS REFER TO EC-TYPE EXAMINATION CERTIFICATE AND APPROPRIATE SECTIONS OF THE MANUAL





Introduction to Hydrosteel 7000

Operation Cycle

Hydrosteel 7000 operates a 10 minute measurement cycle. At the end of each cycle, 4-20 mA outputs step change to provide the most recent cycle data measurement, and store all data and diagnostic measurements to the internal memory. The unit draws a controlled flow of sample gas from the probe into the unit, where the concentration of hydrogen gas in the sample is measured. The instrument sequentially measures hydrogen in sample gas drawn from the background probe (~3 minutes) and flux probe (~3 minutes). From the differential response, the flux is calculated and data outputs are updated. The rest of the cycle (~4 minutes) is dedicated to clear down for a zero measurement and diagnostic measurements, as summarised below.

Time	Operation
0 to 3 minutes	Hydrogen zero measurement
3 to 6 minutes	Hydrogen background reading
6 to 9 minutes	Hydrogen flux reading
9 to 9.5 minutes	Hydrogen sensor diagnostics
9.5 to 10 minutes	Data stored in memory & 4-20mA outputs updated

Connectivity

- 1 mains power supply 15-24 V @ 34 mA in hazardous area
- 4-20 mA output #1: hydrogen flux requiring loop power of 8-30 V @20 mA
- 4-20 mA output #2: pipe temperature requiring loop power of 8-30 V @20 mA
- RS232 connection for optional interrogation of unit: all data is logged to the unit's internal memory probe connection.



Introduction to safety certification

Apparatus certification (ATEX)

Hydrosteel 7000 has been issued with EC-type examination certificate Baseefa04ATEX0205 BASEEFA 2001. Confirming compliance with the European ATEX directive 94/9/EC for group II, Category 2 gas atmospheres, EEx ia IIC T4 ($T_{amp} -40^{\circ}\text{C}$ to $+60^{\circ}\text{C}$). This instruction manual describes the installations that conform with PD60079-12:2000 electrical installation in hazardous areas. When designing systems for installation outside the UK, the local Code of practice should be consulted.

Certification label information

The certification label is fitted on the top outer surface of the enclosure. This shows the certification information plus the Ion Science Ltd name, location, instrument serial number and year of manufacture. Other non-European certification information may also appear on this label.

Hydrosteel 7000
 S/No: "***_*****"
 Manufactured: "Date"
 Baseefa04ATEX0205
 Ex II 2 G EEx ia IIC T4,
 C E 1180
 $-20^{\circ}\text{C} \leq T_{\text{ambient}} \leq +60^{\circ}\text{C}$
 Ion Science Ltd, Cambs, England

Note: The specified operating temperature range for the Hydrosteel 7000 is -20°C and $+50^{\circ}\text{C}$, due to constraints on the internal components.

System certificates

Currently no system certificates have been issued for this equipment. The Hydrosteel 7000 can be operated safely in the hazardous area utilising a range of safety barriers. See *Power and signal requirements* in the *Installation* section for full details.

Main power supply

When installed in a hazardous area the Hydrosteel 7000 must be powered from galvanic isolator, safety barrier or IS power supply. The power supply must meet operational and safety requirements. In addition, the power supply must not create a spark risk in conjunction with the power cable. The specific cable parameters allowed will depend on the safety barriers use.

4-20mA outputs

The 4-20 mA outputs are 2 wire loop powered. That is, for operation in addition of a 4-20 mA receiver, there must be a loop power source. This source must be intrinsically safe or supplied through an appropriate safety barrier or galvanic isolator.

RS232 Connection

Non-hazardous Conditions

Under non-hazardous area conditions the RS232 port may be connected to a self-contained battery powered computer containing 30 V or less. This allows connection to most laptop computers.

Hazardous Conditions

If the laptop is to be used in the hazardous areas local safety rules must be followed. Often all that is required is a suitable permit and the use of an explosive gas detector to prove that the local area is safe at the time of download. Under hazardous conditions this circuit must only be connected to a galvanically isolated intrinsically safe RS232 connection.

To summarise;

- The Hydrosteel 7000 can be installed in zones 1 & 2 in the presence of most common industrial gasses.
- A Safety barrier or isolator is required for the main power supply.
- Safety barriers or isolators are required for the 4-20 mA outputs if they are used.
- A portable computer may be used to download data provided local rules such as permits and safety precautions are followed. The use of a standard laptop does not invalidate the HY7K safety certificate.

See *Power and signal requirements* in the *installation* section for full details.



Installation

The following sequence of installation steps are recommended.

- HY7K probe site identification
- HY7K analyser site identification
- Power and signal requirements.
- Cable requirements
- Remove cladding and insulation
- Preparation of test site
- HY7K probe installation
- Thermocouple installation
- Re-insulation and cladding
- Installation of sample conduit
- Mounting of Hydrosteel 7000 analyser

See *installation summary* drawing for an overview of requirements.

The *Commissioning* section addresses the following items required to complete the installation:

- Attachment of the sample conduit to the analyser
- Connection of electrical connection to HY7K
- Inspection of the installed equipment
- Start up, Set up and operation test

HY7K probe site identification

Suitable sites for Hydrosteel 7000 flux monitoring are primarily identified by the benefits conferred by measuring flux at the specific location of interest, as further identified in the *Hydrosteel Applications Manual*, available from Ion Science Ltd. Frequently, the value of flux measurement at a particular site is confirmed by routine spot flux measurement with the Hydrosteel 6000 spot flux analyser. Probe compatibility with surface steel geometry and temperature is defined in the *Technical Specifications*. The user is also invited to consider the ease of installation at prospective test sites, and their proximity to sites appropriate for Hydrosteel 7000 analyser location, see addressed points below.

Caution:

The weather resistance of the Hydrosteel system is dependant on the probe installation. The probe must be sheltered from water and dust ingress as this will block sample flow and prevent operation. This may be done by applying insulation and cladding, and/or a suitable shelter as appropriate. Water running down the outside of the pipes must be considered, especially if the probe is situated on the underside of equipment. It is important to shield from water access even on hot pipes as in heavy weather conditions the water will evaporate to form steam which will condense in the sample tube and instrument.

The probe is fixed to the test site by one of the following methods. The appropriate fixing method should be identified in advance of installation to ensure correct planning of provisions for installation:

- **Jubilee® clips** - to pipes or vessels of minimum 2" (using the AT-S probe)
- **Banding** - to pipes or vessels of 4 to 32" diameter
- **Magnetic attachment** - to pipes or vessels of greater than 32" diameter. Maximum temperature tolerance is 800°F 426°C
- **Stand** - for large diameter, very high temperature equipment

HY7K analyser site identification

The Hydrosteel 7000 probe must be installed within reach of the probe, employing the 10m (32ft) long sample conduit provided. Allowance should be made for securing the conduit between the probe and analyser to cable trains or other suitable support means.

The Hydrosteel 7000 is housed in a tough glass reinforced polyester enclosure. The lid, RS232 connector, cable glands and all fittings provide IP66 protection. The unit may be installed in any location provided environmental limits defined in *Technical Specifications*, are not exceeded. The ideal location for the HY7K should be accessible without scaffolding. So that it may be accessed for data downloads and servicing.



Installation

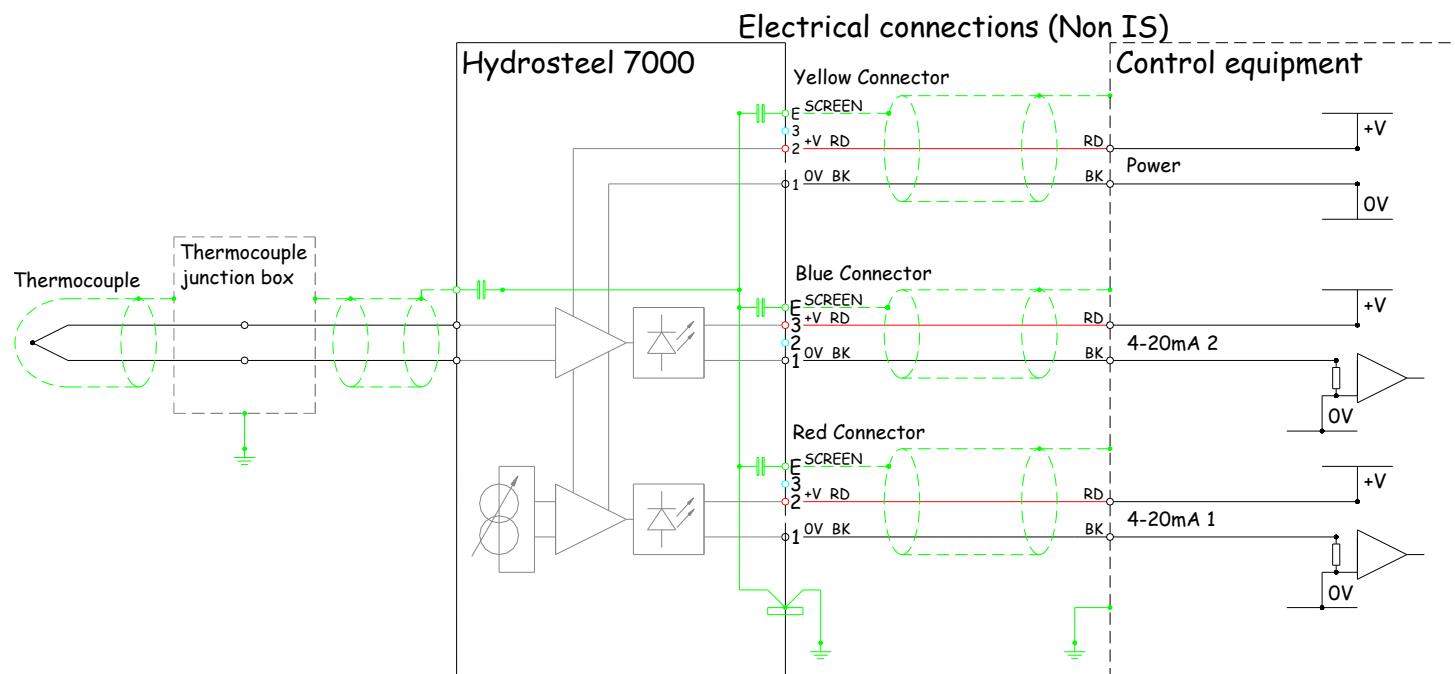
Power and signal requirements

Non Intrinsically Safe (Non IS) applications

Input power 15-24 Volts 35mA

4-20 mA power 8-35 V dc. 22mA

The Hydrosteel is to be wired up as per the wiring diagram below.



WARNING! Non Intrinsically Safe (Non IS) applications

When the unit is installed with a non IS rated power supply the IS details on the front of the unit are not appropriate for the system. The IS label should be covered up or blocked out. This will prevent safety discrepancies and or mis-use in the future should the equipment be moved or the site be re-defined as a hazardous area.

Intrinsically Safe (IS) applications

Entry parameters

Power receivers	Ui	Ii	Pi	Ci	Li	Uo	Io	Po
Units	V	mA	W	uF	mH	V	mA	mW
PS 1	30	200	1.2	0	0			
PS 2	30	200	1.2	0	0			
4-20mA 1	30	200	1.2	0	0			
4-20mA 2	30	200	1.2	0	0			
RS232	30			0	0	13	3	50

For information only see safety certificate before installation



Installation

Ion Science Ltd suggest using the following or similar safety barrier or IS isolator for IS approved applications. The system must be designed by a suitably trained engineer and approved by the local safety authority.

Power Supply:

Suggested barriers for INLET power supply

Manufacture	Manufactures pt. no.	Type	Cable length estimate m
Pepperl & Fuchs	KFD2-VD-Ex1.1835	Galvanic Isolator	560
Stahl	9175-10-16-11	Galvanic Isolator	335
MTL Ltd	MTL4023	Galvanic Isolator	365
MTL Ltd	MTL7728P	Zener barrier	288
Turck	MK72S06-EX	Galvanic Isolator	686

* Note

- All cable lengths are estimated for Zone 1 IIC installation of the equipment
- Using 1 mm² C.S.A. conductors S.T.P. cables with capacitance of 250 pF/m, L/R ratio of 25 uH/ Ω conductor resistance at 20 °C of 18.4 Ω /Km
- Calculation assumes that cables are at 80 °C (maximum operating temperature).

Signal Output

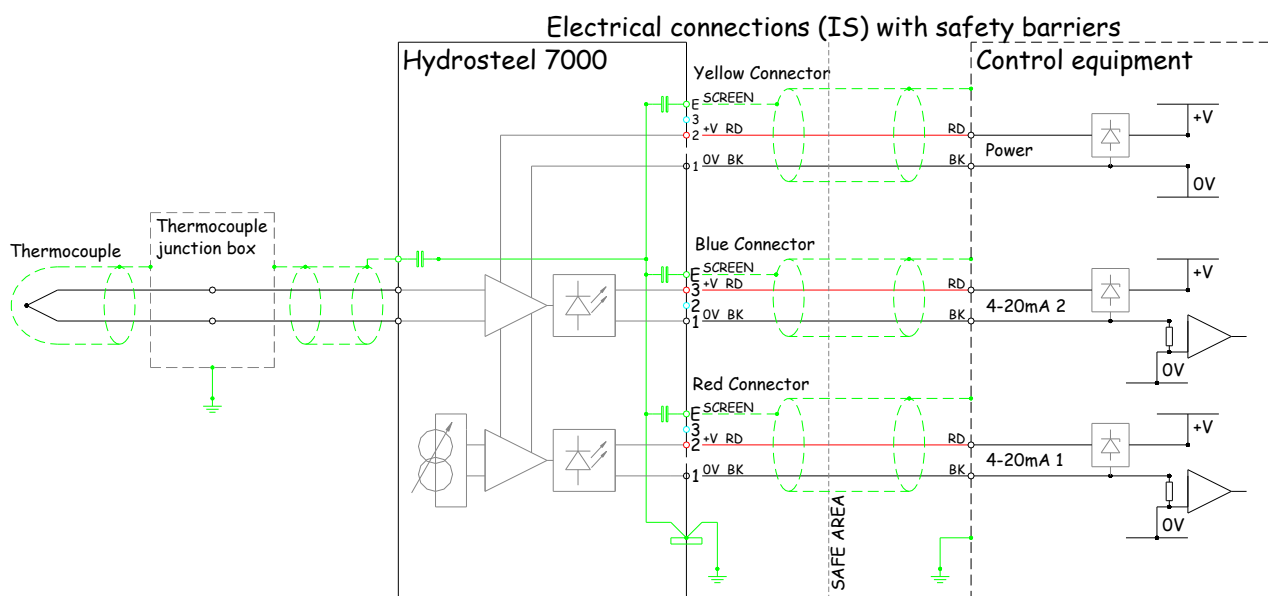
Suggested barriers for 4-20mA OUTLET

Manufacture	Manufactures pt. no.	Type
Pepperl+Fuchs	Z728	Zener barrier
Pepperl+Fuchs	KFD2STC4-Ex1	Galvanic isolator
MTL	MTL7787 (dual channel)	Zener barrier
MTL	MTL5044 (dual channel)	Galvanic isolator
Stahl	9001/51-280-110-141	Zener barrier
Stahl	9160/13-11-11S	Galvanic isolator

WARNING! Intrinsically safe (IS) applications

HY7K fuses may not be replaced in the field.

If a fuse is blown the Hydrosteel 7000 will require inspection by Ion Science Ltd or and Ion Science Approved Service Centre before it is used in an IS application.



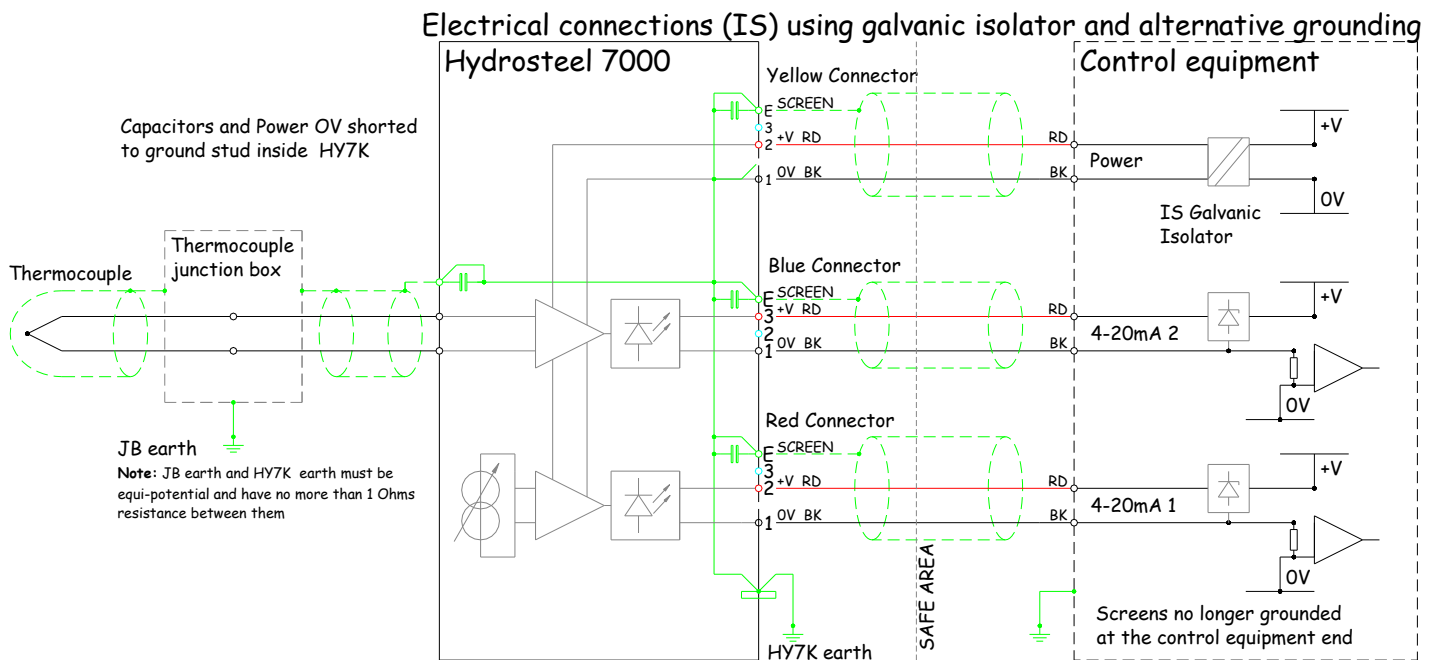


Installation

Use of Galvanic isolator and alternative grounding

Galvanic isolators may be used instead of safety barriers in the above circuit. If an isolated supply is used, the supply at the instrument should be checked for AC noise. Measure the AC voltage between the 0 V and the local earth. If there is AC noise this needs to be removed. It might be due to a faulty power supply or induction of AC onto the cables. To remove the noise it might be necessary to ground the 0 V to an earth point either in the control equipment or at the HY7K instrument. For electrically noisy environments the optimum grounding is shown in the wiring diagram below. It is essential to follow the following key rules:

1. Screens may only be grounded at one end.
2. If the Power supply 0 V is grounded at the Hydrosteel then a suitable rated Galvanic isolator must be used.



Cable Requirements

To meet the EMC compliance for immunity it is required that power and 4-20 mA current loops are supplied with screened twisted pairs. Pairs should be individually screened with the screens terminated in the safe area and to the terminals on the Hydrosteel 7000. (Note the Hydrosteel does not allow DC earth loops to ground down the screens).

Removal of cladding and insulation

Hydrosteel flux measurement requires intimate contact between the probe plate and test surface, so it is necessary to remove any insulation from the target sites.

For ease of access during probe installation, cladding and insulation should be removed from a 1 ft distance from the centre of the site for flux monitoring. Additionally, if the probe is to be fixed with banding (to pipes and vessels of less than 32" diameter), insulation and cladding must be removed from the entire circumference of the vessel or pipe under test.

Preparation of test site

The surface should be free from ridges such as weld filets which could prevent the collector plate from making intimate contact with the steel surface.

The identified test site surface should be at least 4", in diameter, to accommodate both the probe and magnetic thermocouple assembly. This surface should be free from rust and flaking paint which might otherwise prevent hydrogen flux from exiting the steel surface.



Installation

HY7K probe installation

The probe consists of the AT-S probe the background probe and the Thermocouple probe. The AT-S probe may be fixed in place using magnets or banding depending on the test site geometry. The background probe is attached to the AT-S probe using clips. The thermocouple probe is magnetic and may be placed directly on to the surface of magnetic steels.

AT-S and background probe installation with banding

Components

To affix the probe, you will need two equal lengths of banding appropriate for the target pipe diameter. That is the pipe circumference plus 30 cm for tool operation and fitting of buckles. Ion Science recommends that standard 3/8" (9.31 mm) width 0.015" (0.38 mm) gauge Stainless steel banding and buckles be used. This uses a specialist band-tightening tool. Banding kit may be purchased as an accessory.

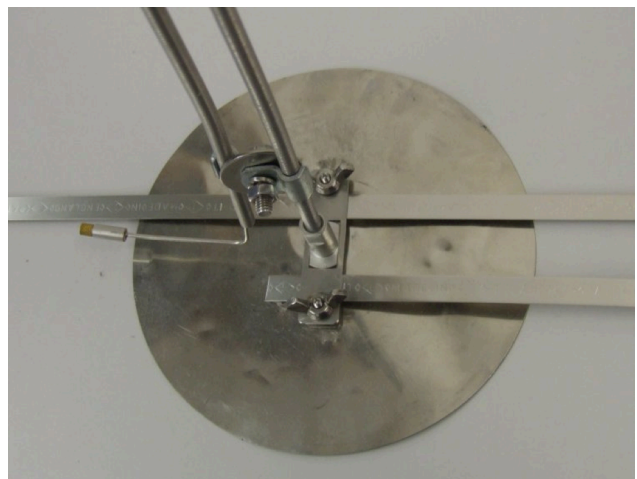
Items required are:

- AT-S probe collector plate
- Back ground probe
- Probe clips A-910227
- Band tensioning tool
- Band cutters
- x2 Banding buckles
- x2 Banding lengths to suit pipe (3/8" - 0.015" gauge)
- Wire bush for preparing the metal surface
- PPE (personal protective equipment)

Pre-assembly

Best done in a clean environment off-site,

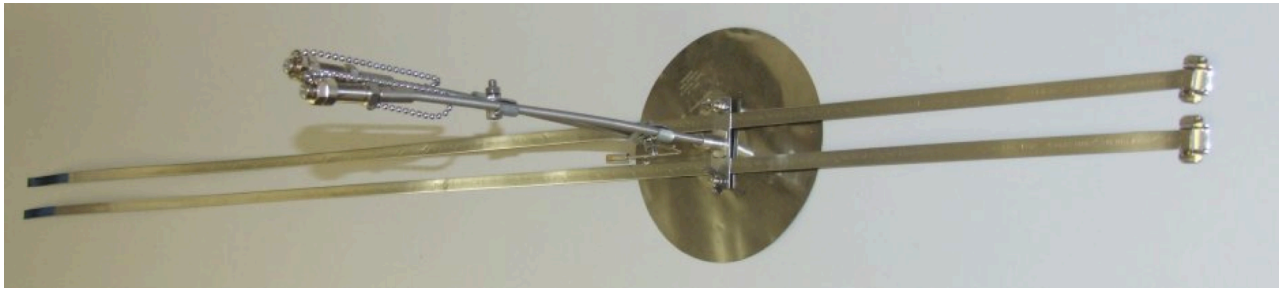
- Assemble the background probe on to the AT-S probe using the probe clips.
- Prepare the banding by cutting it to length. Equal to the Pipe circumference plus approximately 30 cm. For difficult installations longer lengths may be required with the banding being cut afterwards to remove the excess.
- Fit the buckles to the banding following the manufactures instructions
- Fit the banding into the support bracket on the AT-S.



- Manually adjust the collector so that it is located at a distance equal to $\frac{1}{4}$ of the target pipe circumference from the buckle end of the strap. Loosen or tighten the butterfly nuts as required. Ensure the collector cap is secured to finger tightness.



Installation



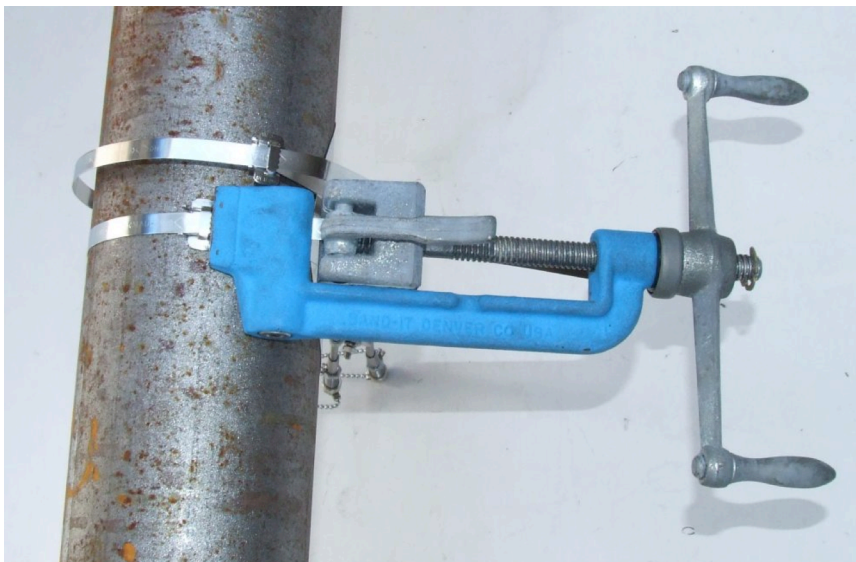
- If it is desired to measure the flux on opposite sides of a pipe e.g the 12 O'clock and 6 O'clock (top and bottom) then a second AT-S probe may be fitted to the same banding. Fit the seconds AT-S probe at length of three quarters of the target pipe circumstances along the banding.

Relocation to target site

- A hot work permit is not required for installation of the probe as the requirements are purely mechanical and non-destructive.
- Ensure you are equipped with the collector assembly, banding assemblies, band tensioning tool suitable PPE (personal protective equipment), and a stiff wire brush to remove loose rust from the test site if necessary.

Step 1: Check again that you can access the entire circumference of the target pipe section and that it is free from loose rust. Use the wire brush to remove residual rust if necessary.

Step 2: Fit the collector plate to the appropriate place and pass the banding round the pipe circumference; secure this into the buckle and tension following the manufacturer's instructions. For hot pipes, it is very important to let the banding heat up to the temperature of the pipe as the banding will expand and lengthen. In these circumstances, tension the banding using the tightening tool and leave the tool in place for sufficient time for the banding to reach temperature, re-tension the banding as necessary before locking the banding off.

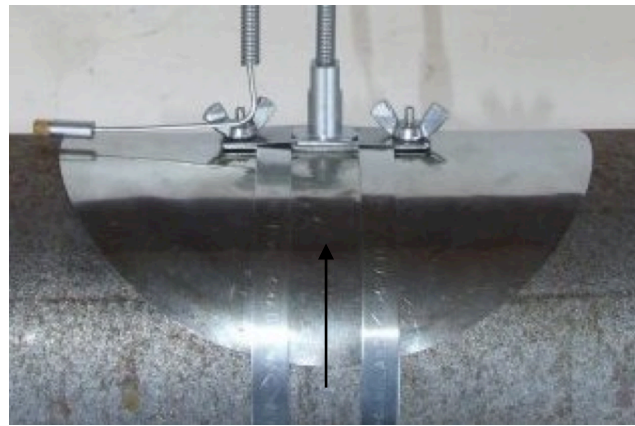
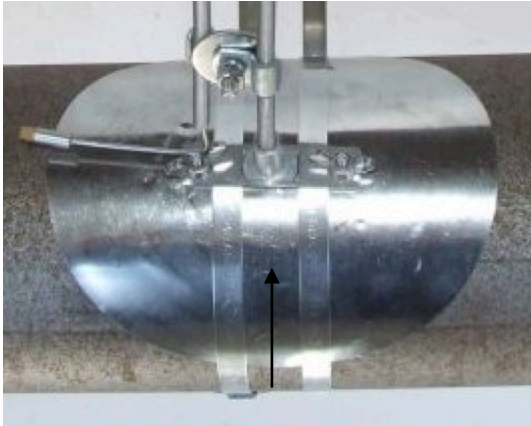


Step 3: Check that the probe is held correctly in position and that they are fully pressed against the piping surface, particularly at the probe perimeter points identified in the accompanying diagrams.

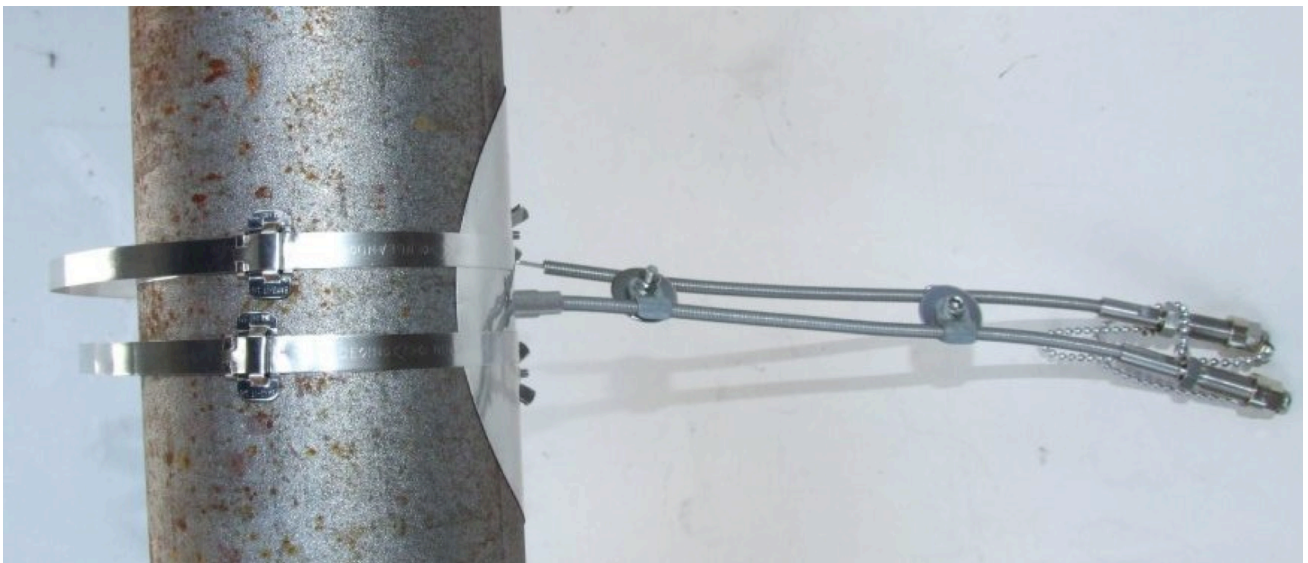


Installation

Also check that the bands are fully parallel. *NB:* The probe can slide along the banding by loosening the thumbscrews on the probe brackets, provided the banding is not too tight onto the pipe. Check the banding buckles are a reasonable distance from the plate so that the banding runs flat against the steel surface and then onto the collector plate. If the band buckles are very close to the collector edge the banding may not pull the collector plate flat on to the surface with no or only a very small gap.



Step 4: Lock off the banding as normal, following the banding manufactures instructions. Wait 3-5 minutes! Due to expansion of the banding attached to pipe at elevated temperatures, it may require tightening after some time. Re-check probe tightness and positioning as per *step 3* and retighten or refit banding as necessary.



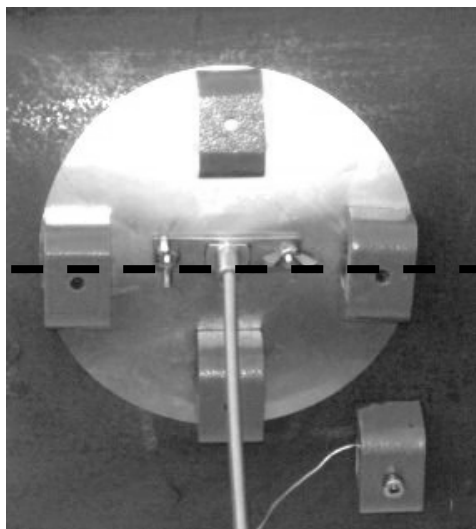


Installation

AT-S Probe Installation with Magnets

Step 1: Press the collector plate against the target steel surface so that it conforms to pipe or vessel curvature.

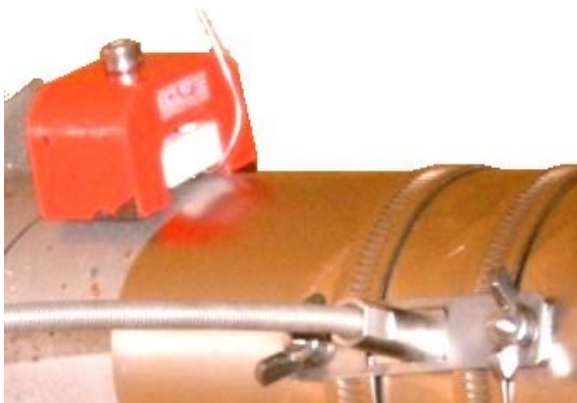
Step 2: With the probe held in place, attach the magnets as shown in the diagram below. Note: The max working temperature for magnets are 800°F 426°C



Axis of pipe or vessel:

Note magnet orientation

Thermocouple installation

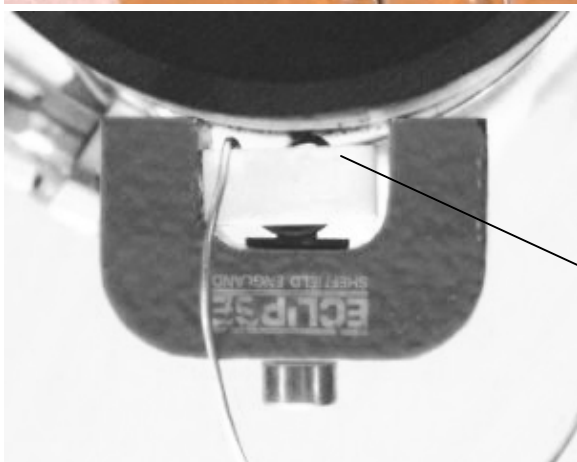


Care should now be taken to prevent the magnet from tugging the thermocouple lead. The thermocouple is semi-flexible and further care must be taken when handling to prevent damage by repeated flexing of the lead at a single point.

Max working temperature for magnets is 800°F 426°C

The magnet thermocouple should be fitted so the magnet legs bridge across the pipe or vessel curve near the location of the mounted probe, as illustrated below.

Once fitted the screw should be tightened using an Allen key, until the thermocouple tip is pressed firmly against the steel as illustrated. (Care should be taken when doing this as excess tightening could crack the ceramic block)



Re-insulation and cladding

Weather shielding for the probe is essential to prevent water ingress blocking the sample flow and preventing operation. This may be achieved by installing insulation and cladding with the use of sealing bungs or tape.

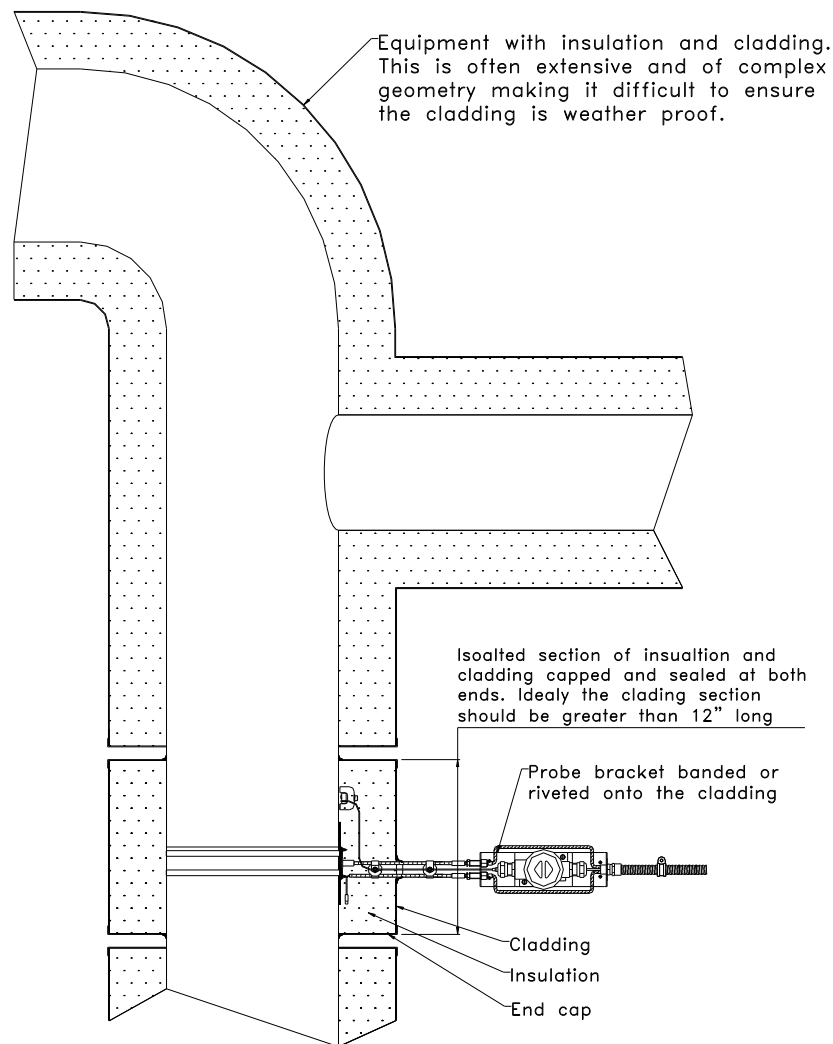
Alternatively a custom made cloche might be used for exposed pipes or where insulation is not needed. Ion science recommends that a short segment of insulation capped at each end is used to cover the probe. (See the diagram below).



Installation

The cladding joints and probe exit from the cladding should be sealed with a suitable sealant to prevent the ingress of water. This arrangement has a number of advantages:

- The insulation around the probe is isolated from the general equipment insulation by the cap. This will prevent / reduce water that gains access through damaged cladding from penetrating to the area of the probe.
- When inspecting the integrity of weather protection only the short section of insulation needs to be inspected.
- When repairing the cladding, checking for water ingress or inspecting the probe only the short section needs to be opened.

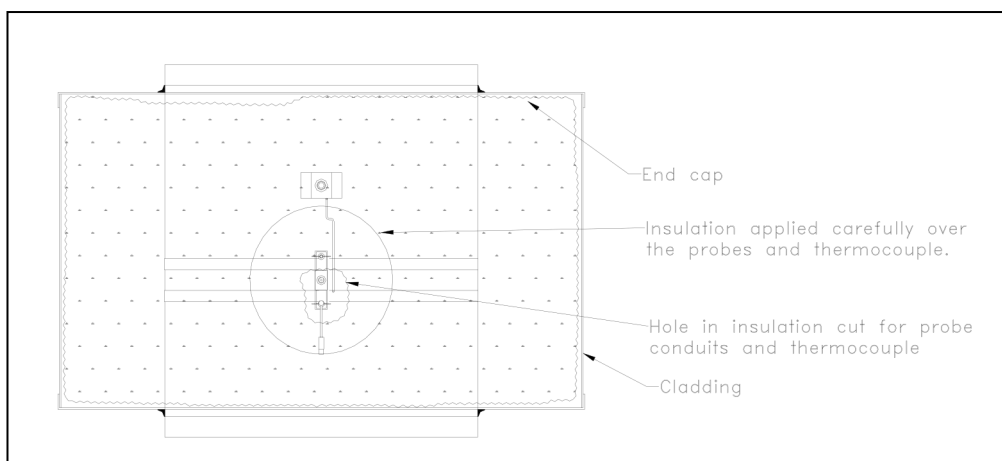


The test site should be insulated and clad with the probe thermocouple and AT-S probe now in place. Note that the AT-S probe and ambient gas probe caps should not be removed during this procedure; in order to prevent insulation debris and fibres from entering them. The probe capillaries will withstand flexing to about 2" radius; however, flexing of the thermocouple lead should be minimised. It is essential that the AT-S probe plate remains firmly in place, and is not distorted by *tugging* of the capillary conduit.

Make sure the probe cap is in place. The free ends of the probes and sample conduit should either be pushed through a hole in the insulation as it is laid over them, or a slit can be made in the insulation to accommodate them.



Installation



A hole in the cladding should be formed to enable the AT-S probe, ambient gas probe, and thermocouple to emerge approximately radially from the pipe or vessel. A 60 mm cavity such as one for UT inspection ports is often suitable, together with a rubber bung with a radial slit through which the probe capillaries and thermocouple lead emerge.



Installation of sample conduit

Fixing of probe conduit bracket

It is unlikely that the sample conduit, routed from the probe to the analyser, is of exactly the correct length. Generally it is preferable to loop spare conduit at or near the analyser terminus and to work from the secured probe towards it.

The probe bracket is affixed to the 10 m sample conduit and must be secured to enable the AT-S, ambient gas probes, and thermocouple lead to be attached to it. Generally, it will be necessary to fix the bracket to outside of the pipe cladding. The probe bracket may be banded, riveted or bolted into position. It is important to ensure;

- Secure support for the probe bracket, as it prevents forces being loaded onto the probes if the conduit is tugged.



Installation

- Conduit and tails do not rest against hot piping or equipment. As they contain thermoplastic components that may be damaged.

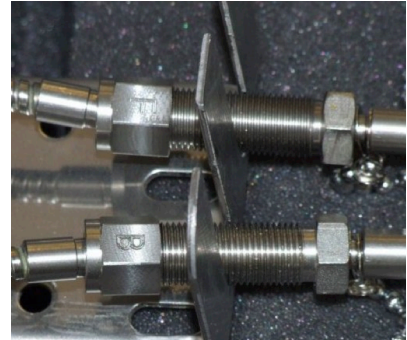
WARNING!

Sample Conduit and tails must not be exposed to elevated temperatures above 100 °C. These temperatures can easily be experienced if the conduit or tails are in surface contact with high temperature process pipes.

Connection of probes to sample conduit

Remove the probe caps. Simply attach the AT-S and ambient gas probes manually using the threaded unions provided. Ensure that the correct capillaries are attached to the correct conduit cable

- Tube with nut marked F (red tube or red cable tie) to AT-S probe
- Tube with nut marked B (white tube or white cable tie) to background probe.
- Tighten the conduit nuts securely (1/8 turn) using 11mm spanners.
- Use cable ties through the slots in the probe bracket to hold the probe connections in place.



Connection of thermocouple cables

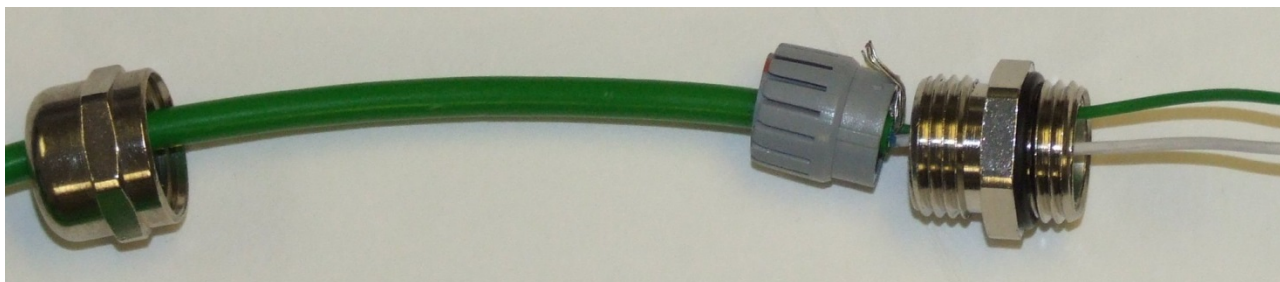
The thermocouple lead terminates in two wires; these must be connected to the thermocouple cable in the conduit at the thermocouple junction box. To maintain the continuity of the thermocouple screen, EMC cables glands supplied must be used. Clamp the thermocouple pot into the cable gland. The internal conductive spring tabs will make electrical contact with the thermocouple sheath and the pot will be mechanically secured when the seal is compressed tight. Please see photographs below that follow.





Installation

If it has not already been terminated, terminate the thermocouple conduit cable into the gland, bend the screen wire back and jam it between the insert and the housing. Please see the photographs below.



Connect the thermocouple wires using the terminals inside the junction box. The thermocouple junction box is mounted onto the probe bracket so it is fixed in place when the bracket is fitted to the pipe cladding. A ground connection should be made from the thermocouple bracket to the local earth for the purposes of screening. This earth may be through the contact between probe bracket and cladding. However if the cladding is electrically isolated or of a non conductive material an earth connection should be made directly to a stud on the probe bracket.

Fixing of sample conduit

Use P clips (1/HF-02) and M5 screws or bolts (not supplied) to fix the conduit to appropriate refinery structures or cable trunking from the probe bracket towards the analyser location. Avoid structures which are liable to exceed 100 °C.

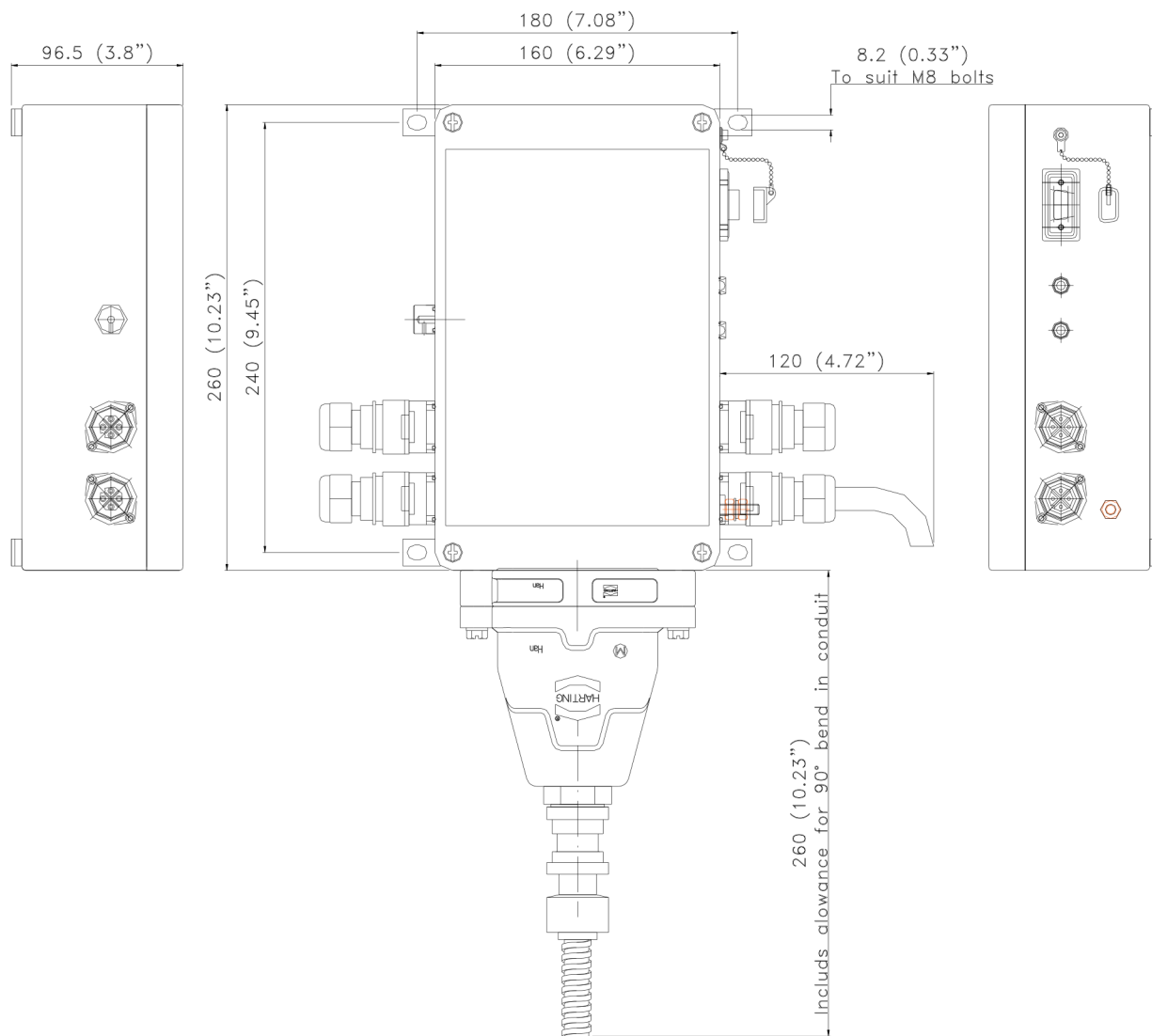




Installation

Mounting of Hydrosteel 7000 analyser

Dimensions for mounting are shown below. The Hydrosteel 7000 can be mounted in any orientation, except upside down, which does not cause entry of water into the exhaust port, for example, during drench testing.





Commissioning

Commissioning is a matter of terminating the probe and electrical connections to the Hydrosteel 7000 unit checking the installation and confirming correct operation. The commissioning consists of the following sub sections:

- Inspection of the equipment installation
- Terminate probe connection to Hydrosteel 7000
- Terminating power and 4-20 mA cables to Hydrosteel 7000
- Start-up
- Operation test
- Hand over

Inspection of the equipment installation

The installation should be inspected prior to commissioning. The following is a check list of features for inspection:

- Probe (if accessible):
 - Clean test surface, without ridges such as welds
 - Secure fitting with the collector plate firmly pressed against the test surface
 - Protect the probe from ingress of water
- Probe bracket to sample conduit:
 - Secure
 - Free of features that might present a danger to personnel
 - Sample tube:
 - Be fixed securely so that is safe from foreseeable damage
- Hydrosteel 7000 mounting
 - Secure and accessible
 - Sample conduit and electrical connections accessible for connections.
- Electrical cables
 - Continuity of cable cores has been tested
 - Insulation resistance between cores and between cores and screen has been tested
 - Connection of cables to correct services has been tested
 - In a hazardous area, the Power and 4-20 mA cables are labelled so that correct connections can be made to the Hydrosteel

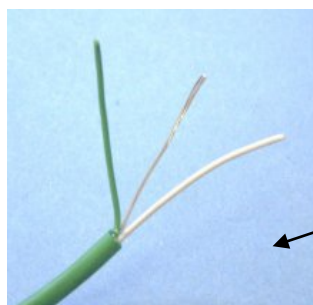
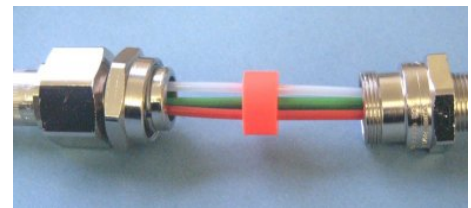


Commissioning

Probe connection to Hydrosteel 7000

Termination of sample conduit with Han connector

1. Fit Harting connector assembly to the Hydrosteel 7000. This assembly is complete with a special Cable gland.
2. Offer the sample conduit from the probe up to the Hydrosteel 7000 and mark the required length of the spiral sheath where it will enter the cable gland on the Harting connector.
3. To maintain traceability of the pneumatic lines after cutting. Mark the tubes above the point at which they are to be cut so that they may be differentiated (using a wrap of insulating tape is an ideal marking).
4. Pull the spiral conduit so that it extends by at least 30 cm. Cut through the conduit using a hacksaw. By extending the conduit this ensures that the sub components (pneumatic tubes and thermocouple) have a 30 cm excess protruding from the conduit when it relaxes.
5. If it has not been possible to mark the tube or the marking has been lost the lines must be traced through by blowing or sucking on the tube.
6. Fit the M20 conduit adapter (1/HG-03) to the sample tube conduit.
7. The cable gland supplied may be one of two types. Type one uses a sealing epoxy compound, type two uses a machined rubber gland. If cable gland that use's a sealing compound is supplied, then the sealing compound should not be applied until the sample conduit has been completed to ensure correct fit. The cable assembly should be fitted dry, following the fitting instructions supplied with the cable gland. Split the cable gland and thread the pneumatic tubes and thermocouple through.
8. Close the cable gland and tighten following the cable gland fitting instructions.
9. Trim the nylon tubes and the thermocouple cable so that 10 cm extends out of the end of the conduit gland. If any extra length is required, the conduit can be compressed to reveal a greater length of cable and tubes.
10. On the end of the thermocouple cable strip 30 mm of PVC outside sheath to expose screen and sub cores.



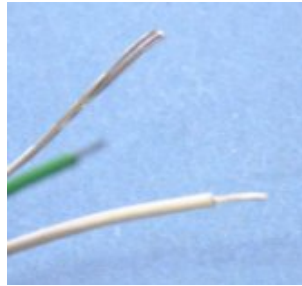
Cut back 30 mm of outer sheath.
Remove aluminum foil

11. Remove aluminium foil screen to the point of exit from the PVC sheath.



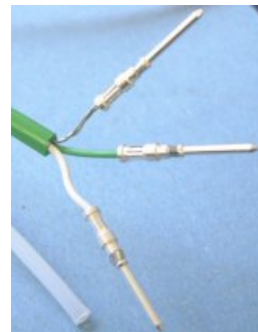
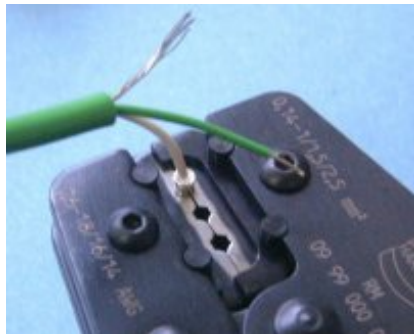
Commissioning

12. Strip 8mm length off white and green wires.

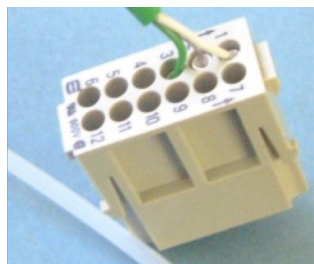


Strip 8mm of insulation

13. Crimp all three wires using crimp contact pins Pt No. 1/JCPB-01. Push the exposed conductor ends into contact pins. Please Note the screen is tight into crimp socket so don't twist the conductors together and tease gently into avoid bending the conductors. If necessary cut 1 or 2 conductor strands out of the bundle to enable it to fit. Use the end location of "Harting service tool" (Harting part number 09 99 000 0021) to crimp.

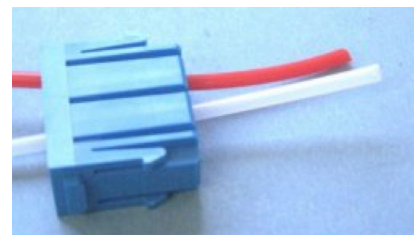


14. Feed the nylon tubes and the thermocouple cable through the male reducer and Han connector housing.
15. Fit crimps into Han DD module (1/JSIB-01) from the rear. The rear of the module is the flat fully numbered sided. The crimps should be fitted as follows according to the numbering on the Han DD module. Pin 1 = white, pin 2 = screen, pin 3 = green. Use "insert tool" (Harting part number 0999 000 0171) (or with care a small flat blade screw driver) to push crimp sockets until they are securely located. (Note: to remove the crimps from the sockets if they are incorrectly placed or require maintenance the "Harting extraction tool" is required).



16. Check the adapter and M20 cable gland parts are tightly fitted to the Han connector housing.

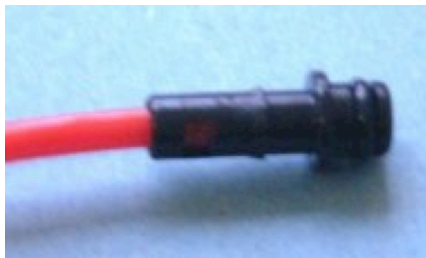
17. Feed nylon tubes through the pneumatic module (1/JNIB-01). Flux through position 1 and background through position 2. Since both tubes are natural in colour marking using black tape for background and red tape for flux has been fitted to the un-terminated end. This may have been lost when the conduit was cut to length. If so trace through the liens by blowing or sucking.





Commissioning

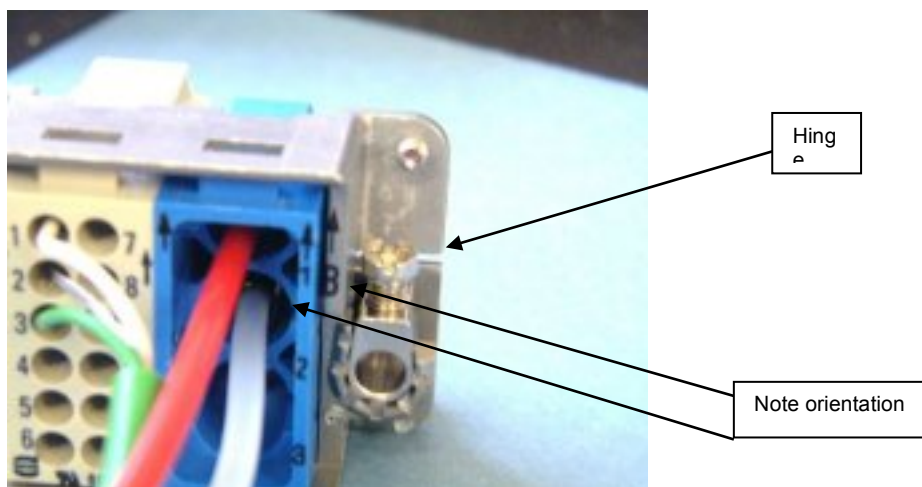
18. Fit the pneumatic connectors on to the nylon tubes.



19. Snap the pneumatic connectors into the pneumatic module.



20. The Han frame ((1/JFIB-02) hinges to allow fitting of the insert modules from the rear.



21. Note frame and modules have keyways to allow only one orientation of fitting. The A↑ and B↑ arrows point to the top of the pneumatic module. With the pneumatic module on the side marked with capital "B"
22. Fit the frame into the Han connector housing.



Commissioning



23. Join the gland housing together.
24. Check the full assembly has been assembled correctly. If cable gland supplied requires the use of a sealing epoxy, open the cable gland and follow the fitting instructions supplied with the cable gland. Apply the sealing compound. The cable gland must be closed before the sealing compound has cured.
25. Once complete, probe connection will be capable of disconnection and reconnection with Hydrosteel 7000. Tighten Han connector screws with flat blade screwdriver to secure the connector.

Additional fixing of conduit if necessary

Use P clips (1/HF-02) and M5 screws or bolts (not supplied) to fix the sample tube conduit to appropriate refinery structures or cable trunking. Alternatively use cable ties.

Connect conduit to Hydrosteel 7000

Connect the Han connector from the sample tube to the Hydrosteel 7000. Tighten Han connector screws with flat blade screwdriver to secure the connector.

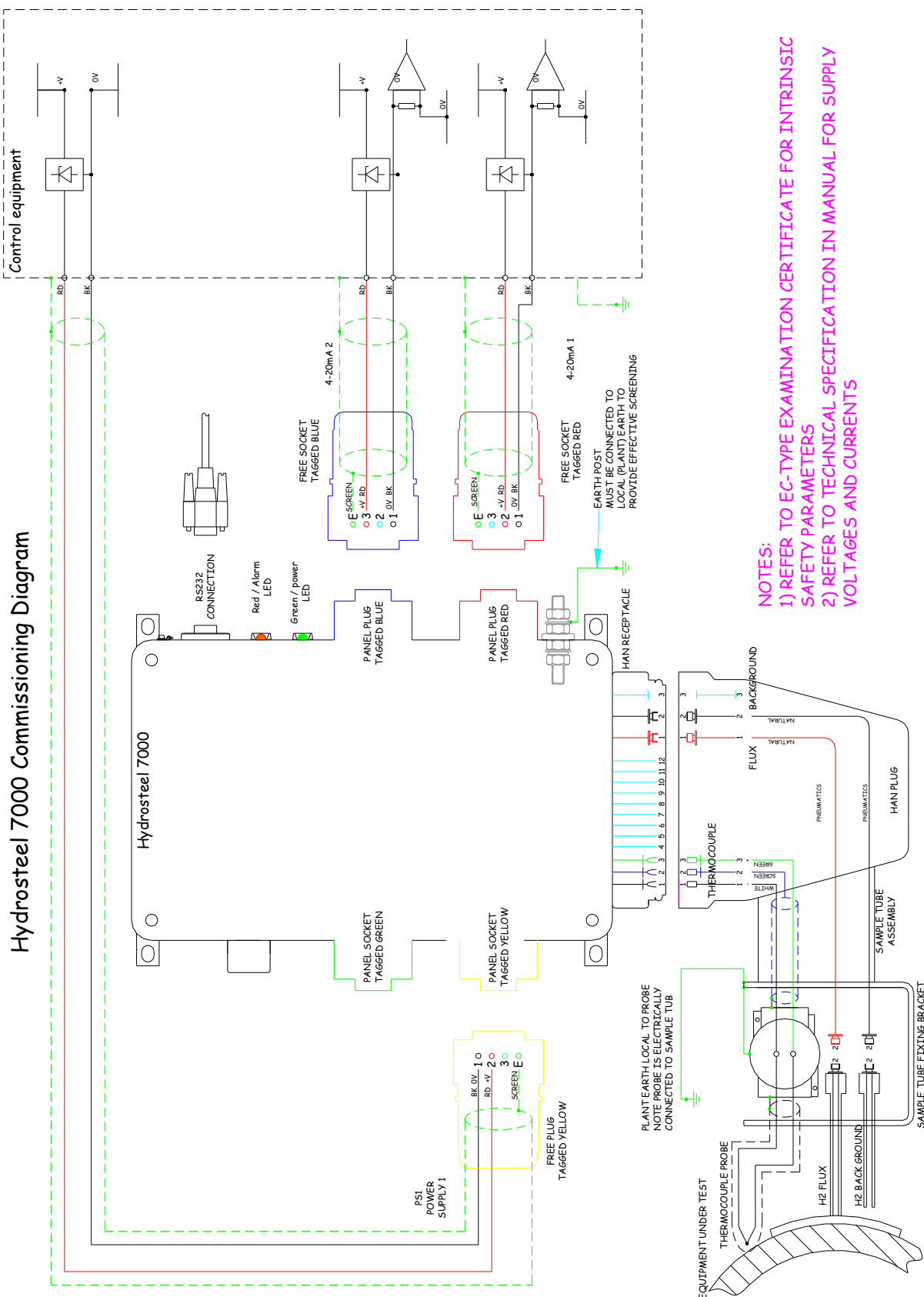
Terminating power and 4-20mA cable to Hydrosteel 7000

IP67 rated cable connectors are supplied with Hydrosteel 7000 so that the instrument may be quickly disconnected, and then reinstalled after servicing. These are colour coded using cable ties. Note the connector pins have been changed to provide key ways and ensure that each connector is individual to the appropriated panel socket. The connectors will fit cable diameter's 6-12 mm.

Terminate the cables following to the connectors as show by the commissioning diagram overleaf. If any connection is not made to the Hydrosteel the mating face of the connector must be protected from water ingress by the fitting protective caps or covering with a plastic bag.



Commissioning





Commissioning

Start up

- Power up intrinsically safe circuit. Green LED on Hydrosteel 7000 should light to show correct power is available to the unit. (the measurement cycle will start automatically)
- Power up 4-20 mA circuit. 4mA should register on each circuit.
- If any discrepancy from the above is encountered see fault finding and diagnostics in the *Maintenance* section

Operation test

Basic test

- Allow the Hydrosteel to complete one measurement cycle (10+ minutes from switch on). If the green LED is continuously lit, the power is confirmed as correct. If the Green LED starts to flash then the power dropped below 15 V (browned-out) during the measurement cycle and it has restarted. See fault finding and diagnostics in the *Maintenance* section.
- If the red LED illuminates, a fault has occurred during the measurement cycle. See fault finding and diagnostics in *Maintenance* section.
- Perform a data download. Check that no diagnostics have failed during the first measurement cycle. If any diagnostics have failed again, please refer fault finding and Diagnostics in the *Maintenance* section.
- The flux reading can be correlated by using a Hydrosteel 6000 close to the Hydrosteel 7000 probe point. Record a Flux reading on the hand over document.
- The pipe temperature can be correlated by measuring the temperature at the probe steel surface or by connecting the Thermocouple to a hand held thermocouple thermometer. Record the first thermocouple reading on the hand over document.

Test if Hydrosteel function test is available

- Disconnect the flux (AT-S) probe and connect hydrogen flood leak sample conduit.
- Allow the Hydrosteel to complete one measurement cycle (10+ minutes from switch on).
- Perform a data download.
- The flux reading should be between 280 pl/cm²/s and 380 pl/cm²/s. Record the flux reading on the hand over document.
- The pipe temperature can be correlated by measuring the temperature at the probe steel surface or by connecting the thermocouple to a hand held thermocouple thermometer. Record the first thermocouple reading on the hand over document.

4-20 mA test

- Both 4-20 mA outputs should be 4mA from unit switch-on of the 4-20 mA power supplies for each output. After the first measurement cycle is complete the 4-20 mA output will be up dated to reflect the current reading.
- The 4-20 mA output after the first measurement cycle can be ascertained by performing a data download and using the flux and pipe temperature readings to calculate the 4-20 mA outputs. See the table below:

Detector	Range		Resolution	Accuracy
	4 mA	20 mA	10 mA	
Flux (AT-F probe)	0 pl/cm ² /s	2400 pl/cm ² /s*	1 pl/cm ² /s	±10 % at cal. Value
Pipe temp	-40 °C	500 °C	2 °C	±2 °C at cal value

- Note: Flux 4-20 mA output range may be changed see *Hydrosteel setup* section.
- Check the initial 4 mA reading and any subsequent readings have been correctly measured by the 4-20 mA receivers.
- Program the correct units and range for each output into the "data collection system". See the table above.



Commissioning

Hand over

1. With the permission of the owner, photograph the unit as installed. The photographs will provide a documentary record of sound installation. Photographs should show the following.
 - Correct probe installation
 - Probe is securely mounted and safe from foreseeable damage
 - Sample conduit has been mounted securely and is safe from foreseeable damage
 - HY7K is mounted securely and is safe from foreseeable damage
 - All connections have been made securely to the HY7K and are safe from foreseeable damage
2. Produce hand-over document with the following details:
 - Customer details
 - Customers PO no
 - Hand-over date
 - Site or location reference
 - Equipment tag number or other reference
 - Add the photographs
 - Operation test results
 - First flux and pipe temperature measurements
3. Have the installation inspected and the hand-over the signed document.



Hydrosteel setup

Clock time

The clock is set to GMT at factory. When unit is interrogated using data download package. The time associated with data points will be automatically adjusted to the time zone set on the computer operating system (Microsoft windows). Whenever a previously saved data file is opened the times are not adjusted.

If the instrument clock time is incorrect for any reason, it can be reset using the data download software. Note that the time is set with reference to the clock on the computer; this must be correct before the clock in the instrument is set. See *Data download software* for further instructions.

Flux 4-20mA output range

The Flux 4-20mA range default is 4mA = 0 pl/cm²/s and 20 mA = 2400 pl/cm²/s. This may be change to 20 mA being from 1 pl/cm²/s to 2400 pl/cm²/s using the "Flux 4-20 mA range" calibration option in the "instrument" menu of the DDP. The Flux range is variable so that it may be optimised for the corrosion application. Please refer to the applications manual or contact Ion Science for assistance.

Operation

One switched on the Hydrsosteel will operate continuously. Every 10 minutes the HY7K will data log and output over 4-20 mA loops new readings.

As users you may decide for a full integrated system where the 4-20 mA data is collected by a data collection system (DCS) and is available immediately for daily use in optimising a process. Alternatively the data log may be relied upon to collect the data. The data would then be analysed periodically in conjunction other corrosion and process data. The analysis and use of data is outside the scope of this manual. Please refer to the Hydrosteel applications manual or contact Ion Science Ltd for technical support.

To download data the Data Download Program is needed. This is software that should be installed on a portable PC so that it may be connected to the HY7K using an RS232 cable, (and if necessary USB adapter supplied). The section below details the operation of the Software. The Hydrosteel has a number of internal diagnostics. If one of these detects a fault then it will be displayed as a red LED on the outside of the instrument, output on the 4-20 mA and saved in the data log. See maintenance section for full details.



Hydrosteel 7000 PC software

The PC software is designed solely to allow the download and viewing of data recorded using the Hydrosteel 7000 unit. Once downloaded data files may then be stored on any computer system and opened for review as needed. The data is displayed in two formats; graphically and as a table of data entries with each row being the data recorded for a given measurement cycle.

The software follows a standard windows format for main functions and is therefore self-explanatory for common operations such as open file, save file etc.

Installation of Hydrosteel Software

PC Requirements

Hydrosteel Software must be used in conjunction with a PC/laptop using Microsoft Windows 98 or later.

First remove any older version of "7K PC software" if they are installed. This is done using "Add / remove programs" option in the Microsoft windows control panel. Select 7K PC from the list and click on the remove button. Note in "Add / remove programs" it may be necessary to pan to the bottom of the list using the scroll bar to find the 7K PC listing. This is because Microsoft has a large number of blanked out entries in the middle that look like the list has ended when in fact they are just hidden.

1. Double click the file called "7K PC setup.exe" located on the Ion Science software CD
2. Follow the on screen prompts saving the software in a drive of your choice (typically your C drive).
3. Click on the 7K PC icon in the ISL directory to start the software. This is found in the Microsoft start "all programs" menu.

On start-up of 7K PC software a quick start menu appears with the most likely initial commands, Open file, Connect to Instrument, Settings and Close.

- Open file - Allows a file previously saved to the PC memory to be viewed.
- Connect to Instrument – connects to the Hydrosteel 7000 for data download.
- Settings – enables the user to select the coms port for connection to the instrument or search for a Hydrosteel 7000 instrument connected to one of the coms ports.

Setup of USB to RS232 coms port

If the Lap –top or PC does not have a dedicated coms port then the USB to RS232 coms port adapter supplied with the Hydrosteel kit should be used. Follow the instructions with this item to load the drivers and set up the operation.

Connecting to the Hydrosteel 7000

1. Connect modem cable from PC coms port to Hydrosteel 7000 coms port. Make sure the instrument is switched on.
2. Start the 7K PC software and select settings. Note if the USB adaptor is used and is attached before PC switch on, then the Software will not be able to open the PC coms port. Simply disconnect and reconnect the USB adaptor to make things operational and continue with the instructions below.
3. Select "Search for instrument". The PC software will pole the existing com ports in ascending order to find which port the Hydrosteel is attached to. Once the instrument has been found select OK to continue. (If the instrument is not found check the power and connections to the HY7K and if necessary use another coms port).
4. Select "connect to instrument" A window will appear as the software attempts to communicate to the Hydrosteel 7000. The top box will confirm the instrument status if the connection has been correctly made. If the communication fails an error message will be displayed "error failed to get data". See *Fault Finding*, under 'Operation'.



Hydrosteel 7000 PC software

The Connect to instrument window

Instrument status - reflects the diagnostic situation of the instrument

Current status and Historic status confirm the current operation and flag if a diagnostic fail has occurred in past operation (since switch on or last data download) respectively. See *Diagnostics*, under 'Operation'.

Instrument Details – gives the following information on the instrument

Instrument serial number

Instrument firmware version

Clock (This is the current date time stamp from the instrument Clock)

Data of first stored record

Last calibration date

Download options

Download data from – this accept a date time to short the download.

Download data

Download calibration – This is for ISL servicing of instruments

Memory dump – This is a last resort option if the memory has become corrupted

Downloading data

Each Hydrosteel 7000 has its own unique serial number. This number is printed on the front of the unit and contained in the unit software. All data downloaded from an instrument is stamped with this serial number. This allows data from multiple units to be distinguished. The serial number is displayed at the top of the graph and data table, and also saved to the top of a “*CSV” export file.

Data download

1. To download the data press download button. There is an option to download data only from a specific date. This might be the date of the last data download. A status bar will appear while the data downloads if the memory is full (1year +) this will take some time.
2. Once the data has downloaded it will be displayed as graph and table.
3. Save the data as required

Erasing logged data

Once the data has been downloaded and saved we recommend that the logged data is erased. This will minimise the data download time and prevent multiple files having the same data.

Graph operation

The graph automatically plots the flux data. For graph options use the graph drop down menu on the tool bar or right click with the mouse on the graph. Option include different data plots, horizontal and vertical gridlines or liner/stair-step interpolation.

A data point can be selected by clicking on graph with the mouse. The corresponding data point in the table will be highlighted blue.

A region of data points can be selected by clicking and dragging on the graph again the data points will be highlighted blue on the graph and table.

Zoom in

To zoom in select "zoom in" icon (Magnifying glass with a dotted box), point the mouse pointer at a corner of the area to zoom in on, click the left mouse button, and drag a zoom box over the required area then left mouse click again. The graph will zoom in on the boxed region. You may zoom in repeatedly as needed.



Hydrosteel 7000 PC software

Zoom out

Use the magnifying glass icon with the minus sign in the middle to zoom out to view complete data set.

Use the magnifying glass icon with the undo arrow to return to the last zoom section.

Status bar

The status bar at the bottom of the graph above the table will indicate Green for correct operation yellow for off and red if there was a diagnostic fault detected with the instrument reading. Data displayed in red indicates a diagnostic flag see diagnostics section on under 'Operation'.

Data table operation

The table shows the data in chronological order with the first data point at the top of the table. Use the scroll bar (quickest) or up down arrows to navigate up or down the table. A data point may also be selected with the mouse. The selected data point will be high lighted on the graph as a fine vertical dashed line. A region of data points may be selected using the arrow keys and holding down the shift key the data selected will be highlighted blue on the graph and the table.

As a default the table shows the following columns of data:

- * Date time,
- * Flux,
- * Pipe temperature,
- * Diagnostic flag.

The diagnostic flag will indicate the status of the instrument at the time of the measurement. If there was a fault it will be stated see diagnostics section for details.

The table may be expanded to show the complete set of readings logged during a measurement cycle by using the expand/shrink table in the windows drop down menu or the expand shrink icon on the tool bar.

These are listed below:

- * Date time,
- * Flux,
- * Valid - Logged data point check sum valid
- * Supply - Supply voltage at the instrument
- * Internal temperature
- * Pipe temperature
- * Pump voltage
- * Pump current
- * Flow
- * Background - Hydrogen background reading
- * Variance
- * Zero - Hydrogen sensor zero reading
- * SR - Hydrogen sensor impedance diagnostic SR pins
- * RC - Hydrogen sensor impedance diagnostic RC pins
- * SC - Hydrogen sensor impedance diagnostic SC pins
- * Diagnostic flag

Data handling

The software can create two file types "*.HY7", and "*.CSV". The "*.HY7" is specific to the HY7K PC package, and cannot be opened by another software package. The package is not designed to edit the data or provide any processing functionality. The "*.CSV" file can be imported into spreadsheet packages such as Microsoft Excel for editing and performing detailed analysis. In addition to the basic operations of open, save and export, the user can save file sections to a new file and merge files together.



Hydrosteel 7000 PC software

Save section

A specific episode of flux in data can be saved on its own. To save a section, highlight the section on the graph with the mouse, then select the “Save Section As” option from the file menu. A save data as dialogue box will appear and ask for a file name and location to save the file.

Merging files

This enables new data to be added to existing files so that a continuous data record is created. Files may only be merged if they do not contain any overlapping data and are from the same instrument. To merge two files, open a file and then select merge from the drop down file menu. This will prompt you to select the second file to merge.

Print options

There are options to print and print preview the displayed graph, table or table section. The graph area printed will be that on display at the time of printing. Should a particular section be desired for printing then the zoom and pan functions should be used to select this as the displayed graph area.

As the Hydrosteel is capable of storing large numbers of data points caution should be exercised when deciding to print table data as it could run to a very large number of pages. It is possible to print a limited section of the table. Simply use the cursor to highlight a section of the graph in blue which will select the corresponding table data points. Alternatively select the table data points using the cursor arrows. Print table section will print this section only.

Instrument Settings

There are the following instrument settings that may be accessed using the 7K PC software:

Set Clock

The clock is set to Greenwich Mean Time (GMT) at factory.

When unit is interrogated using data download package, the time associated with data points will be automatically adjusted to the time zone set on the computer operating system (Microsoft Windows). Whenever a previously saved data file is opened the times are not adjusted.

The clock can be changed by selecting the “Set Clock/Erase Data” option from the “instrument” pull down menu and choosing the appropriate option. Note the time is set with reference to the clock on the computer so this must be correct before the clock in the instrument is set. In changing the instrument clock time all the data in the memory will be erased to maintain data integrity.

Erase logged Data

If the instrument memory is full, data is stored on a scrolling basis. Use the ‘Erase data’ option only in order to delete all data from the instrument memory.

Flux 4-20mA Range menu

This menu enables the Flux 4-20 mA output range to be changed. It is necessary for the instrument to be connected for this operation. Simply connect the RS232 cable activate the “flux 4-20 mA range” window and follow the on screen prompts.

Firmware Upgrade

This enables the instrument firmware to be upgraded for improved operation. Simply connect the RS232 cable to the instrument with it powered up. Open the 7k PC software select “firmware upgrade” from the “instrument” dropdown menu and follow the on screen instructions. You will be asked to find the upgrade file (.upg), this will be provided by ion science by e-mail or CDROM simply select it from it's saved location. Once the upgrade is complete switch the instrument on and off to ensure the new program is active.

Warning: The firmware upgrade must not be interrupted or the operation of the instrument is likely to be corrupted. If this occurs the instrument will have to be returned to Ion science for reprogramming. Ensure that the modem cable is securely connected and if a laptop is used check the batteries have sufficient power.

Select the “firmware up grade” from the instrument drop down menu and follow the directions. No status bar will be displayed during the up grade process so patience is required. The firmware upgrade will take some time. (3-6minutes).



Maintenance and calibration

Hydrosteel 7000 unit maintenance

The unit should be checked routinely for operation and re-calibrated yearly. Re-calibration requires that the unit be returned to Ion Science Ltd for service.

Quarterly maintenance

- Inspection of LED, 4-20 mA outputs and diagnostic data should be stored to memory to ensure that it is running correctly. If the 4-20 mA are used, the diagnostic alarms will be raised as 3.5 mA alarm signals. It is still advisable to check the LED and then if necessary the diagnostic data as this provides additional information.

Yearly maintenance

- Inspect the LED, 4-20 mA outputs and diagnostic data stored to memory.
- Factory calibration and service. This includes testing and possible replacement of H₂ sensor, filters, pump, restriction, back up battery, tubing, valve, fuses.

Note Ion Science does not recommend maintenance in the field that requires the lid to be removed. With the lid removed the Hydrosteel 7000 analyser is vulnerable to water and dirt ingress.

Probe installation

Hydrosteel probes are made of high temperature tolerant materials and are corrosion resistant. The main concerns are; blockage of the probes and conduit by water or rust from corrosion of the target surface or mechanical damage. The following should be inspected yearly and after every shut down:

- The sample tube is secure and free from damage
- The Han connection to the Hydrosteel 7000 is free from damage
- If the probe is accessible check the following:
 - The conformance to the test surface is correct and the banding is secure
 - Evidence of corrosion
 - The probe is free from blockages or dirt debris that may potentially cause a blockage. If appropriate do a quick pressure decay test. No pressure should be supported if the system is free from blockages.
- If the probe is covered by insulation check the following:
 - Inspect at the entry point that no damage has occurred to the probe
 - Check that insulation is secure, sealed and free from external damage that might allow water ingress. Water that penetrates the insulation may block the probe directly or cause corrosion of the test surface under the probe. This corrosion is likely to block the air flow during sampling.
- Check that the thermocouple is functioning. See the diagnostics table for more information.



Fault finding and diagnostics

Fault findings

WARNING!

Ensure plant safety before starting maintenance. Certified test equipment should always be used unless a gas clearance certificate has been issued.

The following table lists the fault outputs and their consequences. Please contact Ion Science or your local Hydrosteel representative if you need any assistance.

Symptom	Cause	Check
No LED lights	No power, Incorrect wiring Fuse has blown	Ensure that there is 15 V d.c. across the power terminals at the unit. Check the polarity; that the positive wire goes to the + terminal. If the voltage and polarity have been incorrectly applied then the fuse may have blown. Note if the fuse has blown the instrument will need to be returned to Ion Science Ltd.
Green LED flashes continuously. *	Insufficient power unit keeps on resetting	Ensure that there are 15 V across -+ power terminals at the unit. * Note the green LED will go off for 2-3 seconds when the pump starts.
Green with alternate quick Flashes of the Red LED	Fault has occurred since last data download or last operation. Fault is not currently present and unit is operating correctly	Perform a data download and look at the log of diagnostics to identify the fault. See diagnostics matrix below for resolve the issue.
RED LED lights	Unit has self diagnosed a fault	Download data to find out specific diagnostic failure. See diagnostics matrix below for resolve the issue.
4-20 mA = 0mA	No loop power or incorrect wiring	Ensure that there is >8 V across -+ power terminals at the unit. Check that positive wire goes to the + terminal.
4-20 mA = 3.5mA	Unit has self diagnosed a fault with given measurement. 4-20mA 1= flux measurement , 4-20mA 2 = pipe temperature measurement	Download data to confirm fault and follow fault diagnostics matrix over leaf.
RS232 connection fails	Communication parameters incorrectly set. Incorrect modem cable. Check red or green LED is lit as fuse may have Blown.	Check com port settings Check the null modem cable used If the fuse has blown then the coms will not operate. The unit needs to be returned to Ion Science Ltd for servicing.



Diagnostics and fault finding

Diagnostics

The diagnostics are saved to the memory with each measurement cycle results. These can be examined by downloading the logged data. In addition the unit will alarm using the Red LED and 4-20mA outputs. The table below shows the diagnostic faults and the actions that should be taken:

Diagnostic Flag	Red LED	4-20 mA 1 Flux output	4-20 mA 1 Temp output	Recommended action
	On	3.5 mA	3.5 mA	
Clock fault	Yes			Clock lost from memory The data points will be saved sequentially in the memory log. Reprogram the clock time and date using the DDP program.
Background flow fault	Yes	Yes		Back Ground Flow incorrect Check the background probe and sample tube. In some extreme cases the blockage may be at the filters inside the HY7K. A pressure decay test may be instrumental in proving the tubes are free from blockages. The most common form of blockage is water. If water has penetrated that system then the tubes will need to be blown out with dry air and the weather protection afforded to the probed will need to be investigated.
H2 Flow Fault	Yes	Yes		Flux Sample Flow incorrect Check the background probe and sample tube. In some extreme cases the blockage may be at the filters inside the HY7K. The most common form of blockage is water. If water has penetrated that system then the weather protection afforded to the probed will need to be investigated.
Hydrogen sensor faulty	Yes	Yes		Hydrogen sensor faulty Return HY7K for servicing. The Sensor is not working reliably
Thermocouple fault	Yes		Yes	Thermocouple open circuit Check the thermocouple connections and continuity. Note the pipe temperature recorded in the data log will be 615 °C as an indication of this fault.
Temperature outside operating range.	Yes	Yes		HY7K monitor internal temperature is less than -40 °C or greater than +50 °C. Investigate the local temperature. If the instrument is too close to hot equipment then it should be relocated to a cooler place. If the ambient temperature is excessively cold then the HY7K will be situated in a heated location.



Technical specifications

Environmental

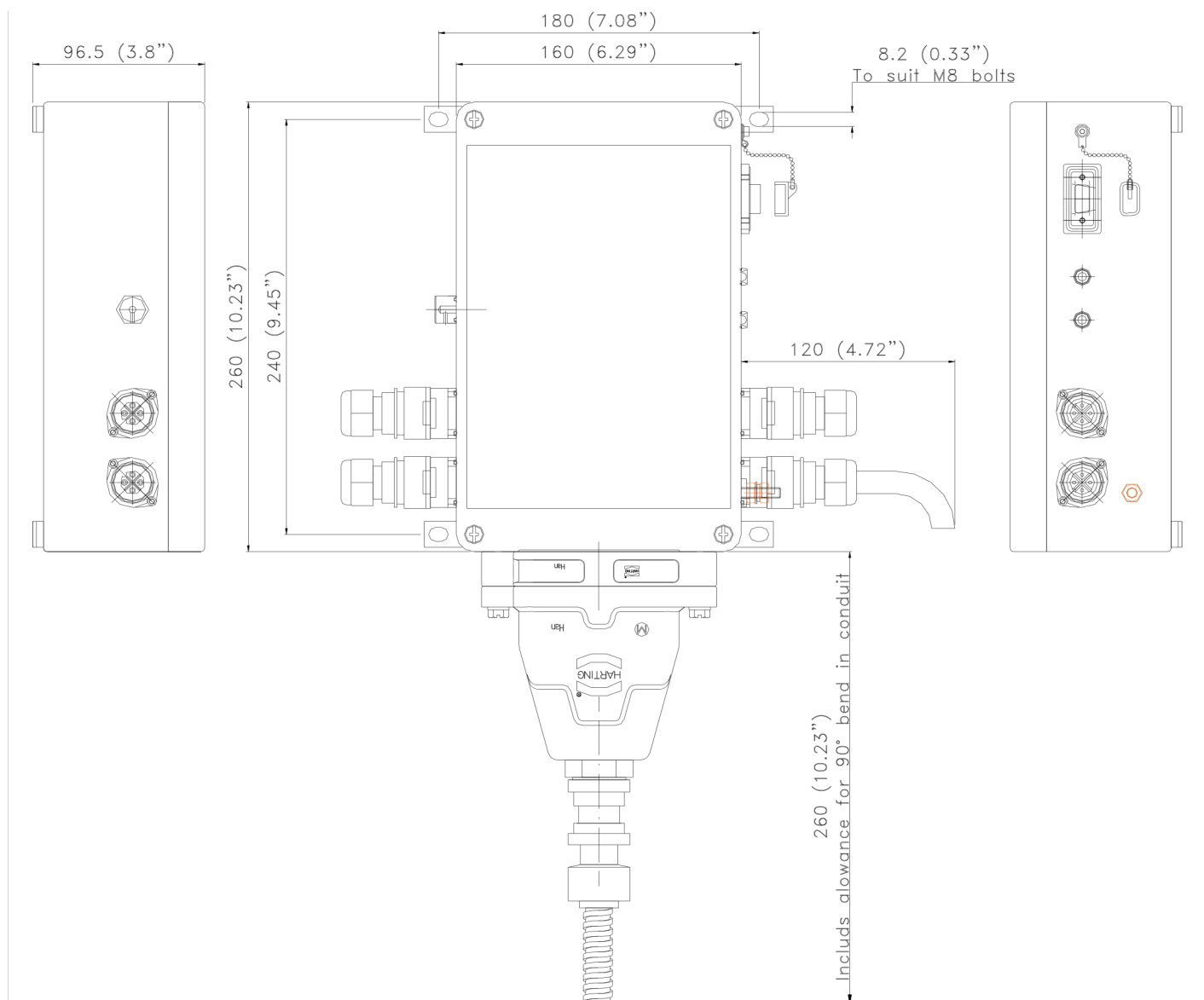
Operating Temperature	-10 to 50 °C (-14 to 122 °F)
Storage Temperature	-25 to 50 °C (-13 to 140 °F)
Zone 1/2 Safe Operating Temperature	-40 to 60 °C (-40 to 140 °F)
IP rating monitor	IP66 (note unit should not be mounted upside down)

IP66 (note unit should not be mounted upside down)

IP rating probe IP40, The weather resistance of the probe and hence the Hydrosteel system is dependant on the probe installation. Caution; the probe must be sheltered from water and dust ingress as this will block sample flow and prevent operation.

Mechanical

Monitor Dimensions & Mounting points monitor





Technical specifications

Communications

- RS232 via a standard modem cable terminated with male and female 9-pin Sub-D connector at each end. Cable length <3 metre. A USB- RS232 adaptor may be used.
- 4-20 mA output for flux
- 4-20 mA output for pipe temperature

Measurements

Logged to memory:

Detector	Range	Resolution	Accuracy
Flux (AT-F probe)	0 to 2400 pl/cm ² /s	1 pl/cm ² /s	±10% at cal. value
Pipe temp	-40°C to +615°C	1°C	±2°C at cal. value
Internal temp	-40°C to +125°C	1°C	±1°C at cal. value
Flow	0 to 60 ml/min	0.1 ml/min	±5% at cal. value

4-20mA output:

Detector	Range		Resolution	Accuracy
	4 mA	20 mA	10mA	
Flux (AT-F probe)	0 pl/cm ² /s	2400pl/cm ² /s *	1 pl/cm ² /s	±10% at cal. Value
Pipe temp	-40°C	500°C	2°C	±2°C at cal value

- Note Range output range is variables from 1 to 2400pl/cm²/s and is selected using the Data Download Package.

Memory

The memory will record approximately 18 months of data. Once memory is full data is logged in a first in first out rolling cycle by memory sector.

Diagnostics

- Operating temp -40 °C to 60 °C
- H2 sensor Electrolytic conductivity
- Flow 30 ml/min +/-3%
- Power alarm Insufficient supply voltage
- Visual Alarm Via red LED on instrument
- Transmitted alarm 3.5 mA on 4-20 mA outputs
- Log to memory

Operating lifetime

Pump

10,000 hr cumulative use

Probe Dimensions

Probe diameter	144 mm
Probe length	10 m (30 ft)
Probe head length	320 mm inc. allowance for 90° bend
Probe conduit diameter	16 mm
Probe conduit bend radius	35 mm

Probe fixing

Banding for >4" up to 32"

Magnets for large diameter pipes where banding not practical. (max working temperature 800°F 426°C).

Note; insulation and cladding are highly recommended and are essential if weather protection is required. EMC. To achieve the immunity detailed above all wiring should be screened twisted pairs.



Instrument warranty and service

Warranty

Standard Warranty can be extended to up to 2 years on the Hydrosteel 7000 when registering your instrument via our website: www.ionscience.com/instrument-registration

To receive your Extended Warranty, you need to register within one month of purchase (Terms and Conditions apply). You will then receive a confirmation email that your Extended Warranty Period has been activated and processed.

Full details, along with a copy of our Warranty Statement can be found by visiting: www.ionscience.com/instrument-registration

Service

Ion Science is pleased to offer a number of service options on our Hydrosteel 7000 product range that allow you to choose the instrument cover that best suits your needs.

At Ion Science we recommend that all of our gas detection instruments be returned for service and factory calibration once every 12 months.

Contact Ion Science or your local distributor for service options in your area.

Find your local distributor by visiting: www.ionscience.com

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Manual log

Manual Version	Amendment	Date updated	Instrument Firmware	PC Software
Hydrosteel 7000 V2.5	Update log added in back of manual	23/12/08	V68	DEV080617.01
Hydrosteel 7000 V2.6	Page 12 – Added Pipe info Page 20 – Letters overlapping sorted	13/01/09	V68	DEV080617.01 AR08060
Hydrosteel 7000 V2.7	Certificates of conformity up dates after standards review on AR0806	2/03/09	V68	DEV080617.01
Hydrosteel 7000 V2.8	Page 32 - print options added to PC SW. Note on use of RS232 adapter. Software installation instructions. P35 - firmware upgrade instructions.	23/06/09	V80	DEV090621.01
Hydrosteel 7000 V2.9	Warranty added on cover Declaration of conformity updated Contents updated Warranty and Service added page 42	23/07/10	V80	DEV090621.01
Hydrosteel 7000 V3.0	Pages 1&4 updated to correct Quality Management System Page 4 Responsibility of use updated and legal notice added	03/03/11	V80	DEV090621.01
Hydrosteel 7000 V3.1	Manual layout and format updated	10/12/12	V80	DEV090621.01